MODIS QUARTERLY REPORT
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Due to the interlocking nature of a number of projects, this and subsequent reports will contain coding to reflect the funding source. Modis funded activities are designated with an M, SeaWIFS with an S, Pathfinder with a P, and Headquarters with an H. There are several major sections within this report; Database, client/server, matchup database, and DSP support.

A. NEAR TERM OBJECTIVES
B. OVERVIEW OF CURRENT PROGRESS
C. FUTURE ACTIVITIES
D. PROBLEMS

A. NEAR TERM OBJECTIVES

A.1 Modis Objectives (M)

A.1.1. Continue to develop and expand the processing environment

a. increase computational efficiency through concurrent operations

b. determine and apply more efficient methods of data availability for processes

A.1.2. Begin extensive testing using global CZCS and AVHRR GAC data with database processing to test the following:

a. algorithm capability

b. machine and operating system stability

c. functionality required for the processing and analysis environment

A.2 SeaWIFS Objectives (S)

A.2.1. Continue testing of processing methodology.

A.2.2. Continue to develop relationship between database and in-situ environment.

A.3 Pathfinder Objectives (P)

A.3.1. Expand matchup database as applicable.

A.3.2. Continue testing of methodology.

A.3.3 Train and integrate new personnel into Matchup Database processing scheme.

A.4 DSP Objectives (H)
A.4.1. Continue testing of processing methodology.
A.4.2. Continue to expand the number of sites supported.
A.4.3. Expand the supported hardware/software platforms

B. OVERVIEW OF CURRENT PROGRESS

B.1 Automatic Processing Database (P)

B.1.1 Operational Testing

B1.1.1 July Operational Testing

Operational runs on three DEC ALPHAS identified a number of points where performance improvement was needed. Numerous changes were made in all aspects of the automatic processing system to improve data throughput. These will be covered in the development section.

B.1.1.2 August Operational Testing

During August, the autoprocessing system underwent its most strenuous testing interval to date, processing global GAC AVHRR data from 88001 through 88213 during the time period of 2 August through 28 August. The processing involved two VAX VMS computers, one SGI 8-processor computer, and six DEC ALPHAS. One VMS machine spooled raw orbit files from the laser disk jukebox to disk. The other VMS computer was responsible for the database, the interface to the database, and the RPC Server. Five of the ALPHAS served as the processing workhorses, taking individual orbit files, breaking them up into manageable pieces, processing those pieces, the recombining them into two files per orbit, one for ascending data, the other for descending data. The SGI computer then copied the ascending and descending orbit files to one of its disks, and when enough data had been gathered, combined the individual orbit files into single daily ascending and descending files. These daily files were then copied to the disks mounted on the sixth ALPHA, awaiting post-processing action (additional cloud masking, product production, tape backup).

B.1.1.3 September Operational Testing

IN September, the processing continued through day 88229, then was discontinued for modifications of the SST algorithm, and development of command files to perform the additional cloud-masking and product production. To test these procedures, weeks 1-12 (days 88001-88077) were cloud masked, and several types of product files produced.

These follow-on procedures are currently run by hand, but will be brought under the automatic processing system soon. A detailed explanation of the procedures currently in use is included in the 'Development' section of this report.

On 10 September, processing was again started at day 88001 with a new SST algorithm. During the next week, approximately eight weeks of data were processed, and this run was used to demonstrate the automatic processing system to visitors from Jet Propulsion Laboratory.

A possible problem was detected in the new SST algorithm. For this reason, week 6 was calculated approximately four times for comparison.

After the SST problem was addressed, and following changes in the record addition process and changes in the database itself (covered in the Development section), processing started again at 88001 on 24 September. By the end of the month, days 88001 through 88116 had been processed, weeks 1-5 had been cloud masked, and product files produced.

B.1.2 Development

B.1.2.1 July Development.

Many changes, large and small, were made to improve the performance of the autoprocessing system. Continuous runs spanning days showed that competition for the database server was going to become a problem. Processes would wait 10-30 seconds for service, at best. The number and types of service were reduced and consolidated in a number of ways.

The size of each piece of a pass was increased from 1200 scan lines to 2400, thus reducing the number of client calls required for each init file. Previously, ascending and descending timebin jobs were separate; they were combined into one job. Two types of jobs that previously ran continuously were modified so they would be spawned off only when

needed. Specifically, the spacebin job, which runs after the ingest/atmospheric correction job, is now spawned by that job. Also, the initial job that copies an input file to the local disk, and releases the ingest/atmos corr jobs for that pass, is now spawned by the job that "cleans" a pass from the local disks. In addition, the program that actually performs the request, running and reporting of the jobs, MCP, was modified to allow for the flexible assignment of "sleep" times between job requests. That is, when an MCP requests a job, but no work is available, the MCP "sleeps" for a specified time, the renews its job request. Previously, all type of MCP's had the same sleep time, 60 seconds. Now, the "fast" jobs (ingest/atmos corr, spacebin, clean) that must execute frequently and quickly, have a short sleep time (30 seconds), while ethos jobs that execute infrequently (timebins) have a much longer sleep time (ten minutes).

Another major change to reduce the client demand concerned the program that adds the MAIN and PROCESS_CONTROL records to the database, ADDRECGAC. Previously, each record to be added required a separate client call. When the 1200-line piece size was used, this resulted in approximate 26 client calls per input file, and still required approximately 16-18 for 2400-line pieces. The ADDRECGAC program and the database interface were modified so that only two client calls were required for each input file, one for the ingest/atmospheric correction and spacebin records, and one for all
other jobs (init, timebin, clean, etc.). This greatly improved the throughput of the server.

Minor problems concerning the ingester, error trapping, and placement of log files and spacing of jobs were also made. Timing statements were placed at all major points, to enable tracking of jobs, as well as identification of bottlenecks. Timing statements within the server itself were placed around database query calls, to allow identification of inefficient calls that would benefit from additional indexes, or a restructure of the query itself, to improve performance.

Spawning of separate spacebin jobs resulted in a problem that required a minor fix. Allowing the ingest/atmos corr job to spawn its own spacebin frequently resulted in multiple spacebin jobs on the same machine at the same time. Since the spacebin program requires a very large amount of memory, multiple jobs would result in serious page faulting, as the spacebins swapped in and out of memory. A method was devised to permit only one spacebin job at a time to execute on each processor. A "reserve" file was used for each machine. If one spacebin starts, it creates

a reserve file. If another spacebin is ready, it must wait until the first is finished, and deletes the file. This method was also used system-wide to allow only one VMS-to-local UNIX disk copy to be performed at a time. While this method is not ideal, it seems to be working well for the time begin, but will be improved in the future.

A problem was identified in the incorrect tagging of scan lines as "ascending" or "descending." In order to sidestep this problem, changes are being made in ADDRECGAC to split the pass into pieces that are entirely either ascending or descending. This is requiring major changes, and as of the end of July were still being worked out. So, the current method of splitting passes into pieces follows.

When ADDRECGAC first opens a file, the time and scan line of the last line in the file is retrieved. A text file is opened, and the time and scan of the last line is entered into the file, and the time of the last scan of the previous pass is retrieved. A second text file is searched for the times of the north, south, and "nextn(orth)" crossings appropriate to that pass. For passes that occurred over a two-day span, various cases occurred. See the July MODIS report for a detailed analysis.

Finally, extensive operational testing identified several failure or stall points that were not evident with prior (less intensive) runs. Failure traps were added to all program calls and DSP command procedure calls that permitted one retry of a failed program or procedure. If the retry also fails, the database is notified of an error, the failure is logged into a local information file, and processing continues on the next piece.

The problem of a stalled MCP process will need further attention. There is currently no automatic identification of a stalled process, and the progress must be monitored. Currently, the steps through an MCP process are:

Starting out:

1. A shell file and DSP file has been created by a db_Request call.

2. MCP runs the shell file, which
   Runs DSP
   Runs the DSP file, which
      Runs the steps (workspace vars, path*.dsp command files
      Runs a dbreport that just writes status, errinfo to a file
      Return control to shell file

Return control to MCP

3. MCP Read the info file
4. MCP calls client dbreport, to report to db, which
   Create client
   Pass info to server
   Server marks rec 'finished'
   Server triggers or releases other recs as/if needed
   Returns control to client & MCP
4. MCP calls client dbRequest, to get next job
   Creates client
   Passes request to server
   Server gets record number of next job, if any ready

IF NONE READY:

Server returns control to client & MCP

5. MCP waits specified time (currently that one minute) then re-requests

IF A JOB IS READY:

Server retrieves the process steps, workspace vars and any other info
Server writes out a shell script and the *.dsp command file to be used
Server returns control to client & MCP

6. MCP runs the script - i.e., back at step 1.

Currently, there is no way to trap a stalled DSP procedure. A "timer" is planned, which will "awaken" MCP after a specified time, and report a stalled job to the database, retrieve another job, and continue processing.

B.1.2.2 August Development

Three new autoprocessing recipes were developed that comprise the first quality control procedures.

PathWeekly1: Makes a weekly ascending and descending warmest-pixel composite for the requested week.

PathWeekly2: Makes a reference maps for the requested week. For example, to create a reference map for week 3, weeks 2, 3 and 4 are warmest-pixel composited, then weeks 1 and 5 are used, if possible, to fill any pixels that are still missing. Then, the ascending and descending files are averaged. When the program is ready, this reference file will be median filtered prior to cloud masking.

PathWeekly3: Cloud masks the daily ascending and descending files, using a threshold with respect to the reference image. After cloud masking, any products will be made from the 9km bin files before tape backup and removal from the system.

These three recipes were run by hand during their development, and will be added to the autoprocessing system during the next round of operational testing.

Product Production

Command files were written that will be called in the Pathweekly3 recipe to create various data products. These are:

Pathtime-weekly: Uses the pathtime program to create weekly ascending and descending files for the requested week.

Pspc-18 & Pspc-1d: For all files for a given week, create 18 km and 1-degree versions of the 9 km files.

Pathcomp-2day: Makes 2-day composites of the 18km psts

Pst2oa: Converts files from pst format to Dr. A. Mariano's objective analysis format.

Several command files were also used and adapted to make DSP image maps from the pst format files.

Many changes were made throughout the system to improve or enhance performance.

Under some circumstances, a processing MCP program may stall. A "timer" has been added to the MCP program. After a job has been spawned, MCP will retry the job once, then report an error back to the database if the job does not complete in a specified period of time.

The GAC data can, at times, be noisy. Previously, this was not well handled. Incorrect records would be added to the database, and the input file would not be identified as a problem. More checks were added to ADDREC to isolate these problem files, and identify them for further attention. In addition, checks were made the scan timestamps in the file, which greatly reduced the number of problem files.

Many adjustments were made to the method used to split up the pass into easily processed pieces. Problems found with the original file used to define the pole crossings were solved. A mechanism was added to allow the use of a variable-sized buffer around the poles.

Only one spacebin job per processor and one input file copy system wide can be permitted. Previously, this was done using a "reserve" file. If a job was running, other jobs would wait to complete. This caused problems in the case of job stalls. For example, if a spacebin job stalled during the execution of the pathbin program, the reserve file would be created, but never removed. Even if the MCP timer marked the job as a DSP ABORT, the reserve file would still continue to prevent further spacebin jobs from operating. This was even worse for the VMS-to-UNIX copy job. If one job stalled during a copy, not further files could be processed until an operator fixed the problem. The database interface was changed to look for executing jobs, and only release spacebin or copy jobs when no other spacebin or copy jobs were executing. So, even if one process stalls, the MCP timer will, at some point, mark the job as aborted, and processing can continue.

At times, multiple spacebin jobs would accumulate on an individual processor. These jobs would request jobs multiple times, until their turn came, thus greatly increasing the client/server traffic. Therefore, the spacebin job was changed from a job spawned by the ingatcor job back to a single continuously running job.

A new field, "miscinfo" was added to the process_control table. This field, when queried for the spacebin job, identifies a piece as either ascending or descending. ADDREC was modified to correctly fill this field for the ingatcor and spacebin records. The spacebin recipe was modified to extract this information and the command file used to perform the spacebins use it to run the correct version of the space bin program.

Testing has finally verified that the method of splitting a pass between days has been corrected.

B.1.2.3 September Development.

The individual command files used to cloud mask the 9KM pst files and produce the products were finalized. The products to be produced will be listed later.

The new program, pathspc was integrated into the processing stream, to product the 18km and 1-degree PST files.

The batch command files needed a more efficient way to 'break' in the processing (for example, if the log file is growing too large). Previously, the 'addrec_stop' signal had to be issued, then the operator had to wait for it to exit before restarting the batch job. (If the old one was working on a file, the new one would see it in the directory, and start to add its records.) So, a new 'signal' was added to addrec: "Maint" (maintenance) - when this is signaled, addrec will finish the file it is working on, submit a new version of itself, and exit.

PATHNLC was modified to a weekly climatology file, to aid in the detection of bad data. The database processing recipe was modified to add the name of the "week" to the DSP procedure file, and the processing command files were modified to automatically create the name of the appropriate weekly climatology file from the week, and enter it a command line parameter in the call to the PATHNLC program.

In the September runs, the primary bottleneck became the record-addition process. The time needed to scan the file for the pole locations caused the ADDREC program to take approximately 8-9 minutes to run for each input file. The program used, ADDREC, was split into two separate programs, GETSCAN and ADDREC. Previously, ADDREC had scanned the input file to determine the time that a satellite transited over the poles, used this information to determine the BEGSCAN and ENDSCAN of each piece, then added the appropriate process control records to the database. It generally took 4-5 minutes to scan the file for the pole crossings, and 3-4 minutes to add the database records. The new GETSCAN program now searches the input file for the pole crossings (and overlap point with the precious pass), and stores this information in a disk file. Then ADDREC reads this file, and uses the information to find the beginnings and endings of the pass pieces. So, on VMS, the new job flow is now:

1: Files are loaded into gac_load from laser

2: Files are moved into gac_getscan by mvfiles batch job

3: Batch job getscangac finds files in gac_getscan. It looks in a "pass_time" file. If the overlap/north/south/nextn/end information is present, the file is renamed to gac_addrec. If the info is not present, it is found from the

file, and entered into "pass_time" file, and the input file is then named into gac_addrec. If errors occur, the file is renamed to gac_aperr.

4: Batch job addrecgac finds file in gac_addrec, reads the pass_time info, splits the pass up, using the "elim_overlap," "pole_buffer" signals, and adds the database records. If this completes correctly, the input file is renamed to gac_tocopy, and the GAC_INIT record is SUBMITTED, indicating that the file is ready to process. If there's a problem, the file is renamed to gac_aperr.

Post-processing Procedures

The steps in the follow-on procedures are:

1. Make ASC (ascending) and DSC (descending) weekly warmest-pixel composites. (Procedure PATHWEEKLY1 from August.)

2. For each week, create a reference file by: Make 3-week ASC and DSC warmest-pixel composite (week before, week of, and week after), then filling any blank pixels from two weeks before and two weeks after, and then averaging the ASC and DSC pixels. (Procedure PATHWEEKLY2 from August.) If spatial filtering of the reference image is needed, it can be added to this command file.

3. The ASC and DSC daily files are cloud masked using the threshold reference file. Any pixels that vary from the equivalent reference pixel by more than a set amount (currently 2 degrees) are flagged as bad data. (The value of the pixel is not changed, only a particular bit in a quality flag that is associated with the pixel.) (Procedure PATHWEEKLY3 from August.)

4. Several command files are run to make the products from the 9km binned files. A weekly ASC and DSC file is first produced by PATHTIMING the daily files for that week. These files are in the PST binned format with a resolution of 9 km. The new program PATHSPC is used to produce files of different resolutions. The weekly files are used to product weekly files at 1-degree resolution, to compare with climatological fields produced by other researchers. The SST, standard deviation and count values are then mapped from the PST format into DSP image format. Daily and weekly files are also produced at 19 km resolution. These files are used to produce three types of 2048 X 1024 global DSP images:
1. ALPX contains all pixels
2. GOOD contains all pixels flagged as good' prior to the cloud detection procedure

3. DCLD contains all pixels still flagged as good after cloud detection. Another command file makes a 'no-header' version of these maps, for those who don't use DSP for image display. The 19 km files are finally used to produce a 2-day warmest-pixel composite (ASC and DSC), and converted into another format for use in an objective analysis project.

B.2 Client/Server Status (S)

B.2.1 July Client/Server Development

In July, two weeks worth of CZCS data were processed using both existing VMS routines and the newly modified programs on Unix. The data went through the following steps:

Processing Environment	
VMS	Unix
ingest	
ANLY	
space bin	space bin
mosaic	mosaic

The new Unix based programs use the output of the VMS ANLY program. Restated, CZCS data was processed through ANLY and then processed through CZCS space/time bin programs; the same set of level-2 images was processed using the SeaWiFS space/time bin programs. Histograms of the two sets show the same distributions.

B.2.2 August Client/Server Development

B.2.3 September Client/Server Development

B.3 Matchup Database (P)

B.3.1 July

The primary contributor for the matchup database has been traveling for the past three weeks. July activities will be included in the August report.

B.3.2 August

During this month we continued the development of candidate Pathfinder SST algorithms. The emphasis is both on (a) low rms in SST residuals (in situ SST minus satellite SST) and (b) unbiased residuals, with no significant trends across a range of conditions (e.g., scan angle, environmental temperature).

At the same time, we made the transition from testing algorithms using solely the matchup database to producing global SST fields. The global fields were composited into weekly intervals, to allow comparison with similar fields produced by Dr. Richard Reynolds of the Climate Analysis Center. The Reynolds fields are based on optimally interpolated temperature estimates from both in situ (buoys and ships) and satellite data. The initial comparisons were conducted using the first 12 weeks of 1988 and they were presented during the Pathfinder algorithm meeting. A series of coding errors was identified and corrected during the testing.

The matchup development effort continued with the reception of NDBC buoy data for January-July 1992. This data will be ingested soon and added to other in situ SST measurements to extend the temporal coverage of the matchup database (currently encompassing the period 1988–mid 1991). Canada's Marine Environmental Data Service (MEDS), the organization that serves as the repository for global drifting buoy data, was contacted and drifter data were requested for the second half of 1991 and 1992.

B.3.3 September

Matchups

The matchup activities during this quarter involved the compilation of additional in situ SST data. These data are being ingested to extend the temporal coverage of the matchup database (currently encompassing the period 1988–mid 1991). We received magnetic tapes with NDBC moored buoy data for the period January-July 1992. Before these data are processed, we wanted to obtain the data for the rest of 1992, as it is simpler to process data in one-year units. The NDBC data for the second half were obtained through the Internet using a special account set up for us by NODC staff. The data retrieval was interrupted by the move and reorganization of the computer system at NODC. We expect to complete the transfer of 1992 NDBC data by the end of October.

Canada's Marine Environmental Data Service (MEDS), the organization that serves as the repository for global drifting buoy data, was contacted and drifter data were requested for the second half of 1991 and 1992. These data were received and are in the process of being ingested. The MEDS data prior to mid-1991 were obtained from Dr. C. McClain's group at GSFC. The GSFC group performed quality control of those data using a suite of tests (e.g., thresholds on drifter estimated speed, limits for valid SST gradients, etc.). Although the data set obtained from MEDS now includes some quality flags, we

have contacted our GSFC colleagues and requested details on the tests performed by them, to ensure consistency in the matchup data sets. The MEDS data are our priority at present, because they are the only missing data source for 1991. Once these data are ingested, we can build global matchups for NOAA 11 for 1991.

We have also made arrangements to expand our collection of in situ data from the AOML drifters and the TOGA/TAO moored arrays. These data sets have not been received yet.

We have provided access to our archive of in situ SST data for 1988 to colleagues at the Univ. of Miami who are working on a NOAA-sponsored program to improve tropical SST fields. The techniques that our colleagues are developing as part of their project will be useful for evaluating the Pathfinder SST products.

SST algorithm development

During this period we continued the development of candidate Pathfinder SST algorithms. The emphasis is both on (a) low rms in SST residuals (in situ SST minus satellite SST) and (b) unbiased residuals, with no significant trends across a range of conditions (e.g., scan angle, environmental temperature). We explored the behavior of various candidate algorithms under different ranges of scan angle, environmental temperature and time. All the algorithms evaluated have remaining model inadequacies under some combination of conditions (e.g., high temperatures and high scan angles). Another insight gained during this period is the presence of a temporal trend for the 1985-1988 NOAA-9 data. This trend is currently the subject of intensive examination.

At the same time, we made the transition from testing algorithms using solely the matchup database to producing global SST fields. The global

fields were composited into weekly intervals, to allow comparison with similar fields produced by Dr. Richard Reynolds of the Climate Analysis Center. The Reynolds fields are based on optimally interpolated temperature estimates from both in situ (buoys and ships) and satellite data. The initial comparisons were conducted using the first 12 weeks of 1988 and they were presented during a Pathfinder algorithm meeting. A series of coding errors was identified and corrected during the testing.

B.4 DSP Support (H)

B.4.1 Testing:
B.4.1.1 July
Test 9k bin bit mask for land masking to PATHBIN.
Test new program, PATHMASK, to mask bins from a PST file.
Test new programs to convert between image mask and 9k bin bit
B.4.1.2 August
Test 9k bin bit mask for land masking to PATHBIN.
Test new program, PATHMASK, to mask bins from a PST file.
Test new programs to convert between image mask and 9k bin bit
B.4.1.3 September
None listed

B.4.2 Modifications/Additions to DSP:
B.4.2.1 July
Allow a subsampling factor larger than 10 in CONVRT.Modify MIA2TIFF to not require navigation information in the input image.

B.4.2.2 August
Decode values properly in COLORSHR (CALGETOZONE.RAT).
In VHRR: Disable CZCS combine code (pads height vector with extra entries); correctly calculate expected read record length; make FLIP= input and display X/Y ordering the same; change GEOM MAG= to have (x,y) order;
In SHPSPH and SHPLIB: correction to adjustment of along-track correction table when near pole.
In PATHBIN: Force type conversion; rename variable IN to IIN for debugging; fix chopping of image due to a pole; force fwd2dn row number to be reasonable; fix error messages in binit, and binit error handling in pathbin; fix handling of invalid bin number.
In UNWARN utility: search routines are no longer used; don't rely on FCSLIB being installed; add support for OpenVMS and Alpha's.
In MAKE-BSD utility: check for Alpha's.
Lots of changes to CALLER for OpenVMS.

Add support for mmap(2) to WRKTLK, DISPLYSHR, GETCOM.
OpenVMS changes to TK library.
Changes to TIFF for OpenVMS.
Changes to TCL library for OpenVMS.
Changes to TABLE library for OpenVMS.
Changes to IO library for Alpha's.
Change all ratfor "iaddr" declarations to PTR.
Add all parameters to IO routines to get rid of nargs().
Make $LS macro (in the MIAMI.RAT include file) the same on
Unix and VMS.
Fix string handling in DBMAN.
In RTLIB: Fix up F77_NO_UNDERSCORES name.
In DSP/MENU utility: special case a single minus sign in an entry.
Fix CALLER to really exit when SIGTERM or SIGINT is delivered.
Fix IO routines to free up the right amount for the subimage header.
Fix handling of calibration structure in LOAD, FASTLOAD, NDVI,
SAVE, and WMEAN.
Fix NDVI makefile for VMS.
In PATHTIME: Properly handle an empty first input file; output audit
record for each input file.
In PATHMAP: Fix string handling; change output bound minimum from one
to zero; fix handling of missing qual or mask bands.
In PATHNLC: Write out audit record with date of sst calculation;
modify sst calculation; modify debugs.
Fix SCRIPP and TIROS to correct ingest from file record count
check (include missing lines).
Allow a subsampling factor larger than 10 in CONVRT.
Modify MIA2TIFF to not require navigation information in the
input image.

B.4.1.3 September
New program, PATHFLT, to median filter a PST file.
New program, OISITU, to convert Reynolds ship and buoy data to
DSP files. New program, IMG2OA, to convert a dsp image file to OA format
(binary file New program, PATHCOMP, to composite PST files).
New program, PATHMASK, to extract from a pst file an area specified by a
bit array mask
Rename PATHSUB to PATHSPC.
Rename IMG29K to IMG2BIT.
Rename 9KLM2IMG to BIT2IMG.
Convert RLREAD from the old DSP.
New COLORSHR7 library to include more of upcoming SeaWiFS algorithms.

New program, LOADSTREM, to load no header data that is not block aligned.

B.4.3 Problems fixed:
B.4.3.1 July:
Change EXAMIN to nicely line up the band number column.
Fix string handling in PATHTIROS ingester.
Fix handling of _STATUS workspace variable.
Fix PALSAV for big endian machines.
Take out "inquire error" message from EXIST.
More string handling changes for 2CHAN.
Fix PATHMAP to not calibrate the quality or mask bands.
Fix PATHTIME to allow an input file with just one line.
Fix string handling and big endian handling in
PATHSCRIPP ingester and ingest library routines.
B.4.3.2 August
Change EXAMIN to nicely line up the band number column.
Fix string handling in PATHTIROS ingester.
Fix handling of _STATUS workspace variable.
Fix PALSAV for big endian machines.
Take out "inquire error" message from EXIST.
More string handling changes for 2CHAN.
Fix PATHMAP to not calibrate the quality or mask bands.
Fix PATHTIME to allow an input file with just one line.
Fix string handling and big endian handling in PATHSCRIPP ingester and ingest library routines.
B.4.3.3 September
In SAVENOHED, zero out the right variable.
In DSP, ignore SIGINT if running from batch.
Use INT32 instead of long in COLORSHR and COLORSHR5.
In ANLY7D, misc. additional debug information changes to fix bug on AXP/OSF;
Catch and mask extreme values before floating point traps; change to colorshr7 library; corrections to interpolation grid calculations.
Remove duplicate #defines from IO calibration routines; SGI IRIX log10(x) sometimes returns log(x) instead of log(x)/log(10.).
In PATHNLC, update NOAA-9 coefficients to values derived from NOAA/Miami collaboration in spring 93; compiler requires larger optimize setting;
Change the 3-5 check; correct chm[45] calculation .. had '-' instead of '+'; change the satz multiplier from .001 to .002 in the TLW calculation; add reference image; fix initialization of interpolation grid; change the equation

date in the audit record (for reference image change; use reference image as a threshold test for the sst
value.
In SIZE, allow plane numbers up to 16.
In PATHMAP, allow use of the filter quality value.
In EXAMIN, take out unused include file; add dump of
PST_GRID_ROWS.
In VHRR, write out workspace variables tape_jdat, tape_itim, and
tape_isat so
Command procedures don't have to use Julian.
In TIROS, assume all five channels are present if there is no TBM header record.
In CONVRT, print proper line number on image write error.
Fix string handling in JHIST.
In PATHCLOUD, write out command line audit record.
In PATHSST, use IMGFILE's instead of int for file pointers; fix
Initialization of interpolation grid.
In SSTLC and SSTLOAD, add EOS to the end of all messages.
In STATS, use merge as a subroutine instead of a function; put
ifdef's around all debugs.
In AVHRRSHR5, add lat and lon arrays to AVLOOP.
In ANLY2D, change interpolation calculations for greater accuracy; remove unused variable; more corrections to setup calculations (resolution dependent error); one more change to grid initialization.
In ANLY6D, correct interpolation grid calculations.
In MAPEPS2, use calculated epsilon 550 to estimate epsilon's 520 and 440 for Lw/Chlor calculations; changes similar to anlyXd to correctly calculate some values.
In CALEPS, changes similar to anlyXd to correctly calculate some values. In ANLY2D, ANLY6D, AVHRRSHR5, COLORSHR, COLORSHR5,
COLORSHR7, MAPEPS2,
PATHSST, and PATHNLC, change along track interpolation (yet again). Was incorrectly interpolating outside of bounding entries (LAST/CURR).
Modified support library to allow coefficient switching to occur at the appropriate time. Changed calling programs to call modified support library (indexing slightly different).
In CALEPS7, update to build with new Gordon/Wang atmospheric algorithm.
In MAPEPS7, update for new Gordon/Wang atmospheric algorithm.
In DBMAN, attempt to make error messages more useful.
In FLTMLIM, fix use of logical command line variable; change some string handling
In FLTR, fix edge zeroing.

In PATHBIN, add valid sst check for quality=2.
In CDFIO, use function to get ncopts.
In BIT2IMG, default output to IMAGE0:.
In IMG2BIT, default input to IMAGE0:; set maximum for resolve to 270. In MINMAX, add option to minmax to zero pixels between min and max.

B.5 Direct Project Support

B.5.1 SeaWIFS (S)

B.5.1.1 July

i. The following activities were performed by Jim Brown of RSMAS is support of SeaWiFS during a trip to the Washington, D.C. area:
Worked with Gene Feldman:
o Installed current DSP Unix software on his SGI system.
o Completed implementation of Gordon/Wang atmospheric algorithm. Testing determined that significant internal changes were necessary to reduce run times. Biggest improvement was by only reading each parameter file once and only calculating certain intermediate data values once. [Testing was completed when Jim returned to Miami. Still investigating methods to further speed it up.]
Worked with Stan Hooker:
o Attempted to get DSP running on NeXT 3.0 and AUX 3.0. Both attempts were failures for different reasons. On NeXT, there are fatal problems in how they have implemented shared memory. Current DSP shared data structures depend on using shared memory. On AUX, something fundamental is wrong with either a) system malloc library or b) system compiler/run time. Everything works fine until DSP program starts up and then DSP dies with an unexplainable malloc failure. Angel attempted to debug AUX malloc problems with no success.
o Collaborated with Stan, Denny Kerwin(Old Dominion), and Richard Mead(NRL) to assemble dataset that supports theoretical and model work Denny and Richard are doing. This paper attempts to explain fundamental dynamic behavior of associated
vortices of warm core rings (particularly of ring 82-B in spring 1982).
o Mentored person learning LabView programming.
o Fought with networking folks: network didn't work properly (several times).
Helped Wayne Esaias:
o Stan and I set up two SGI Indigo workstations (so we could use DSP on one of them).
Visited Dennis Clark (NOAA):

o Met with Dennis. Failed in attempt to get his Mac networking software configured and running. Unclear if hardware or software problem was the culprit.
o Mentored Eric about various Mac programs we (Stan and I) developed on MOCE cruise to quality control and clean up the various collected datasets.

ii. Jim Brown worked with Wang, Gordon to incorporate SeaWiFS Rayleigh-aerosol interaction code, epsilon calculations in to the processing system. As a result, throughput increased from 1 pixel/sec to 170 pixel/sec.
iii. A test image was processed for 79160 east coast US with haze front. As expected, variability present in 550nm band translated into epsilon variability. A 4x4 subsampled image requires 12 minutes to process using new ANLY. Data for test pixels from the test image have been compared using outputs from ANLY and Wang's test programs; the two program set produces the same results demonstrating that the algorithm is correctly implemented.
iv. Wang extended the potential epsilon range by adding code to implement the semi-log epsilon equation when the epsilons computed by the 12 models do not produce an epsilon within their range of applicability.
v. Gene Feldman will create a copy of the VDC process control software for installation in Miami. The basic CZCS processing will be duplicated, then substitution of SeaWiFS modules for CZCS modules will begin.
vi. The implementation of trigger conditions and database structures that support the data day and equal area grid concepts used by the binning programs has been completed. These conditions and structures are being documented for transfer to
Gene Feldman.
vii. A series of discussions has been help with Chuck McClain to define masking approaches for SeaWiFS. These will likely follow the model used for Pathfinder SST processing where an initial set of flags is generated during or immediately following level-2 processing, e.g.., cloud mask and sun glint, and subsequent set of flags is generated by program or interactive analysis of the global daily fields. Incorporating time is being considered as an added dimension and possibly additional external fields. These discussions will continue.

B.5.1.2 August

i. Jim Brown continued working with Wang, Gordon to incorporate SeaWiFS Rayleigh-aerosol interaction code, epsilon calculations in to the processing system.

ii. The implementation of trigger conditions and database structures that support the data day and equal area grid concepts used by the binning programs has been completed. These conditions and structures have been documented and transferred
to Gene Feldman.

B.5.1.3 September

i. Teleconferences and phone conferences. A number of teleconferences and phone conferences have been held to expedite the exchange of information between the Miami and Sea WiFS teams. These exchanges were highly productive and helped define areas requiring greater attention.
ii. Bob Evans reviewed draft specifications for Level 1 to 3 HDF files to determine if sufficient information is retained for Seawifs processing. This in turn initiated a review of the L2 and L3 processing routines to ensure that all required variables are
computed. Results of these analyses have been exchanged with SeaWiFS project personnel.
iii. The Gordon algorithm for Seawifs atmospheric correction has been implemented together with the ancillary data HDF routine. The ancillary data have been incorporated into the atmospheric correction by including pixel level pressure and ozone calculations. Wind speed is used to compute the sun glint mask. The new ANLY7 level 2 program has been used to determine computation times for Seawifs by simulating 6 Lw channels. Results to date suggest that the SGI Challenge upgrade will be able to process Seawifs GAC data at approximately 12 times real time.
iv. In addition to the timing tests, a series of algorithm tests were conducted using several scenes were both the CZCS algorithm and the Seawifs algorithm using CZCS data could be expected to yield comparable results. A special version of the CZCS Level 2 program ANLY5 was developed implementing pixel level epsilon computations (MAPEPS5). The three programs (ANLY5, MAPEPS5, ANLY7) produced normalized Lw within approximately 0.5 count.

B.5.2 MODIS (M)

B.5.1.1 July

i. Bob Evans worked with Gordon and Brown to develop their Algorithm Theoretical Basis Documents.

ii. Bob Evans supplied Al Fleig with estimations of computation times for Brown's SST and Gordon's water leaving radiance computations based on Pathfinder SST and prototype SeaWiFS algorithm implementations. The algorithms were used to process data sets representative of a day's processing.
iii. Bob Evans attended, with Jim Brown, a Hughes pre-System Readiness Review meeting, and they discussed both MODIS processing and distributed processing at SCF's.

B.5.1.2 August

i. Bob Evans continued worked with Gordon and Brown to develop their Algorithm Theoretical Basis Documents.

B.5.1.3 September

i. Bob Evans continued work on the ATBD.
ii. Bob Evans attended MODIS science meeting
iii. Bob Evans and Pete Evans attended EOSDIS SRR for V1.
iv. At the DIPFT, Bob Evans suggested that SCF and PGS processing be made as equivalent as possible such that any scripts, tests, processing... would produce identical results independent of processing environment. Further, rapid emergence of high speed workstations means that substantial processing and analysis can be conducted at the SCF. This in turn requires that network bandwidth and DAADS delivery of products to the SCF needs to be checked for proper sizing.
v. Bob Evans reviewed reports from data processing focus team requested information on data sets to be produced by Dennis Clark during mooring and cruise work
vi. Test data sets were defined for MODIS, 4km data daily, global for ocean visible and infrared channels to construct calibration and algorithm test fields. A limited number of 1km calibration sites will also be established corresponding to mooring locations or cruise tracks. Expect that calibration updates due to long term drifts in the sensor performance will result in 1 - 2 changes in the calibration per year.

B.5.3 Pathfinder (P)

B.5.1.1 July
i. The matchup data for NOAA-9 has been used by C. Walton/NESDIS and Miami to produce candidate AVHRR algorithms. These have been compared in Miami to determine existence of trends with respect to time,

surface temperature, and scan angle. Tests have been conducted for the ensemble of fixed moorings, drifting buoys, and for individual buoys.
ii. A candidate algorithm that has the least residual trends and approaches the minimum RMS error was chosen for the final run of test calculations.
iii. The rate of test calculation production has been steadily improved through reorganization of the production flow and through introduction of DEC/ALPHA processors. At present we are able to sustain 15 data days/day and approach a maximum of 20 days/day. This limit is imposed by the maximum rate at which files can be retrieved from the optical juke box.
iv. A change was introduced into the system to split the full level-1 files into ascending and descending segments during ingest time. This change improves throughput by eliminating checks to determine whether a pixel is located in an ascending or descending segment when the level-1 data crosses the poles. Unfortunately the fast navigation package obtained from the University of Colorado (Bill Emery) does not produce reliable computations of the pole crossing times. This in turn misclassified an unacceptably large number of SST retrievals. We have replaced the pole crossing time calculation with a slower, but reliable, program based on the Miami navigation routines and have calculated new crossing times. These times are now used for global processing yielding complete coverage maps for each daily ascending and descending (day and night) SST field.
v. Computations are proceeding and fields are now available for routine transfer to JPL for final quality control review. The complete processing and scheduling package will be transferred to JPL.
vi. Jim Brown assisted Richard Legeckis (NOAA) with the following to prepare for receipt of Pathfinder data:
o Installed various VMS software updates.
o Installed DAT tape drive.
o Diagnosed local terminal LAT connection problem.
o Installed SONY optical disk drives/interface.

B.5.1.2 August
i. Testing continued using the matchup data sets.
ii. Efforts continued to define objective test fields for Pathfinder data using 1988 data.

B.5.1.3 September
i. Objective tests of pathfinder fields for 1988 data were defined by using objectively interpolated weekly 1 deg (360x180) spatial resolution maps produced by Dick Reynolds. Reynolds provided fields that were FTP copied to Miami and read using a template program.

ii. Comparable 1 deg weekly maps were produced using the 9 km, daily PST files. We now have the capability of spatial and temporal averaging to produce the desired resolution products.
iii. The Reynolds and Pathfinder files have been subjected to two tests. These include time differences of each data set (week N - week N-1) to test for temporal continuity and reasonable geophysical change. The Reynolds time difference fields show areas of blocky or patchy temperatures whereas the Pathfinder fields tend to be smoother. The Reynolds - Pathfinder differences show substantial areas with absolute differences less than 0.3C. Both fields show seasonal changes as time progress from January to July. The R - P fields show difference no greater than the weekly Reynolds differences.
iv. Future research questions exist as to how to determine the best method(s) to insure field quality given the temporal and spatial distribution as well as quality of the available in situ data sets.
v. We have received Reynolds fields for 1987 to the present. Equivalent Pathfinder fields for the first 6 months of 1988 including fields of counts, rms, means, and differences.
vi. The results of the algorithm tests and Pathfinder-Reynolds comparisons were presented during the Ocean SWG Pathfinder meeting on Oct. 14. At the meeting the NLSST and Miami equations were presented and a number of additional tests were suggested.

B.6 Team Interactions

B.6.1 July

B.6.1.1 Robert Evans and Jim Brown attended a meeting with Hughes and discussed machine to machine scenarios for use with V1 ESDIS.

B.6.1.2 Peter Evans participated in both the DOAFT session and a EOSDIS V0 review.

B.6.1.3 Robert Evans attended a meeting of the Data Processing Focus Team.

B.6.2 August

B.6.3 September
A number of teleconferences and phone conferences have occurred on support of SeaWiFS. Additional meetings for the V1 SRR, DOAFT, and DIPFT were attended.

C. FUTURE ACTIVITIES

C.1 Database Future Work

C.2 Client/Server Future Work

C.2.1..
C.2.2.
C.2.3.
C.2.4
C.2.5
C.3 Pathfinder (P)
C.3.1 Continue development with 1 deg (360x180) spatial resolution maps produced by Dick Reynolds.
C.3.2 Continue algorithm tests and Pathfinder-Reynolds comparisons. Present results at Ocean SWG Pathfinder meeting.

C.4 Headquarters (H)
C.4.1. Create tools to assist in result's interpolation.
C.4.2. Verify workstation DSP (SGI, SUN, DECstation, VAXstation) by comparing each program's output with the Adage system.

C.5 Modis (M)
C.5.1. Use test data sets developed to continue test criteria.
C.5.1 Complete ATBD.

C.6 SeaWIFS (S)
C.6.1 Continue testing of Gordon's algorithms and its interaction

with HDF ancillary routines.
C.6.2 Continue timing tests with CZCS and SeaWiFS algorithms.

D. PROBLEMS

D.1 Database Problems

None listed separately

D.2 Client/Server Problems

None listed separately

D.3 Matchup Database Problems

None listed separately

D.4 DSP And Headquarters Related Problems

None listed separately